Magnitude of η Argus, 1909. By R. T. A. Innes.

The comparison stars were, as in former years :—

C. G. A. Cluster Catalogue No. 121,	8·00 mag.	8 colour.
Gilliss 1332, ...	7·60 ,,	4 ,,

The separate observations are :—

1909 Mar. 31	7·75 mag.	5 colour.
Apl. 11	7·8 ,,	6 ,,
,, 22	7·8 ,,	6 ,,

A low power on the Grubb 9-in. refractor was used. The means of the observations by years, which I have made since 1896, are as follows :—

	Mag.	Colour.	No. of Obs.
1896·4	7·58	5·0	4 – 1
1899·5	7·71	7·0	4 – 2
1900·3	7·68	6·3	3
1901·3	7 78	6·8	3
1902·1	7·72	6·5	3
1905·5	7·67	7·5	5 – 2
1908·4	7·75	5·7	4 – 3
1909·3	7·78	5·7	3

These observations show no variation since 1899 greater than the errors of estimation.

Government Observatory, Johannesburg :
1909 *April* 24.

Note on certain Coefficients appearing in the Algebraical Development of the Perturbative Function. By R. T. A. Innes.

(*Originally written in January* 1909 (*but lost in post*), *and rewritten* 18*th. March* 1909.)

I.

We find a short algebraical development of the Perturbative Function in terms of the mean anomalies in Laplace's *Mécanique Céleste.* This was extended by Burckhardt and de Pontécoulant. Later, Le Verrier gave a development to the 7th. powers of the eccentricities and 6th. powers of the inclinations (both inclusive), and this was extended to the 8th. powers by Bouquet. Le Verrier gave extended tables and numerous precepts with his development (*Les Annales,* i. and x.), and in consequence it has been widely used.

A more methodical and general development was given by Newcomb (*Ast. Papers,* v., parts 1 and 4, 1895). Earlier, Newcomb had published a development in terms of the eccentric anomalies (*Ast. Papers,* iii.) which he used in deriving the periodic perturbations of the four inner planets, but it would seem that the further adoption of this development has been tacitly condemned by its illustrious author—it appears to be necessary to state this explicitly, as in a recent didactive treatise on this subject (I refer to Mons. H. Poincaré's *Leçons de Méc. Cél.,* ii., part 1, 1907) the author's references to Newcomb omit his later and more generally useful papers.

The earlier developments (including Le Verrier's) make use of the Laplace coefficients

$$b_{\frac{1}{2}}^{(i)},\ b_{\frac{3}{2}}^{(i)},\ b_{\frac{5}{2}}^{(i)},\ \text{etc. etc.,}$$

and of their derivatives of the first and higher orders. An inspection of Le Verrier's formulæ will show that the coefficients which actually appear are in a slightly different form, viz.

$$b_{\frac{1}{2}}^{(i)},\ \alpha b_{\frac{3}{2}}^{(i)},\ \alpha^2 b_{\frac{5}{2}}^{(i)},\ \text{etc. etc.,}$$

and that the derivatives of these are there implicitly.

Finding the numerical values of the various Laplace coefficients (especially if α is over $\frac{1}{2}$ and accuracy is required) is a wearisome process, but when α is less than 0·75 the actual work required can be lessened by using tables by Runkle and others. Well-known recurrence formulæ exist between the various coefficients, but unfortunately their use leads to accumulating errors.* Le Verrier

* This was pointed out by Le Verrier in one of his earliest papers (Paris, 1841) and is well known, yet we find Mons. H. Poincaré, in the work already cited, recommending their use. Of course the recurrence formulæ are *mathematically* exact, but they are too inaccurate for astronomical use, paradoxical as it sounds!